

Range Control Systems (Intermediate) - A User's Guide

Standard Coast Guard intermediate day/night ranges, as described in this guide, were designed from the ground up to have simple, straight forward, easy to understand, and easy to service control and power systems. Whether the range is powered by PV (photovoltaics, i.e., solar panels), commercially by a 12VDC power supply, or standard commercial 120VAC, the basic control system is essentially the same. Of course, extra precaution must be exercised when installing or servicing 120VAC powered aids.

Please refer to the standard drawings listed here to help clarify the information presented in this guide, or just to follow along with the discussion:

130503 - *Commercial Day/Night Range, 120VAC Signals*

130505 - *Optional Emergency Range Light (For 120VAC Main Light)*

130506 - *Commercial Day/Night Range, 12VDC Signals*

140503 - *Solar Day/Night Range, 12VDC Signals*

140505 - *Optional Emergency Range Light (For 12VDC Main Light)*

140506 - *Solar Day/Night Range, Range Category S-D/N Large Power System*

140507 - *Solar Day/Night Range, Range Category S-D/N Large Power/High Intensity System*

These and other Standard Aid to Navigation drawings are available from the Signal and Power Drawings webpage (<http://www.uscg.mil/systems/gse/gse2/Drawings2a.htm>) in PDF file format.

Additionally, the ***Alternating Current Aids to Navigation Servicing Guide*** (COMDTINST M16500.17) and the ***Short Range Aids to Navigation Servicing Guide*** (COMDTINST M16500.19A) contain official aid servicing instructions and guidance. Please refer to these guides and drawings for your basic servicing needs as well.

At the heart of most standard day/night range control systems is the Range Switch Box (RSB). There is an RSB for 12VDC systems (RSB-DC) and one for 120VAC systems

(RSB-AC). Standard 12VDC systems come in two varieties: power supply and solar photovoltaic. The following is a brief description of each possible power/control combination, both 12VDC and 120VAC:

12VDC - Solar Photovoltaic. The power section in this range system configuration consists of a solar array (solar panels), Local Terminal Boxes (LTB), Low-Voltage Drop Box (LVDB), either a Range Power Box (RPB charge controller) for most applications or a Solar Charge Controller (SCC) for larger solar power systems, and a battery. The solar array collects energy from the sun during daylight hours and, via the LTB and RPB (or SCC), charges the main battery. Proper array and battery sizing is essential for extended aid operation. The Ocean Engineering Division's user-friendly Solar Design program can help you achieve this easily. You can find the latest version software (program) on our Pubs/Software webpage here:

<http://www.uscg.mil/systems/gse/gse2/Publications.htm>. The RPB (or SCC) (brains behind the power section) controls the battery's health by attempting to maintain an acceptable state of charge (SoC), usually between 80% and 100%. It does this by monitoring the battery's voltage and disconnecting the array or the load when necessary thus preventing dangerous overcharge and equally damaging deep-discharge conditions, both of which are extremely detrimental to battery life. Under normal battery SoC, power from the battery, via the RPB (or SCC), is applied to the RSB-DC. Depending on ambient light conditions, the RSB-DC diverts this power to either the daytime or nighttime signal, but never to both at the same time. The system is designed to failsafe to the less-intense nighttime signal. The Relay Driver CCA within the RSB-DC continuously monitors outside ambient light levels via the exterior-mounted Type L daylight control (photoresistor). When outside ambient light rises above or falls below specific intensity levels (as determined by the Relay Driver CCA corresponding to the requirements of the CG-493 programmable flasher specification) the Relay Driver CCA will either energize the internal power relay to turn on the daytime signal or de-energize it to turn on the nighttime signal. The signal hardware will usually consist of RL-14 daytime and nighttime range lights. The daytime RL-14 range light can accommodate lamps of up to 110-watts. If using the standard 50-, 75-, 100-, or 110-watt lamps, a CG-

481 high-wattage flasher is required (instead of the standard CG-493) for voltage regulation and lampchanging whether the light is fixed on or flashed. A high-wattage lampchanger is also required. Additionally, if a greater daytime intensity is desired, up to three more RL-14's may be installed in "parallel" with the first daytime range light but must have separate fixed-rhythm CG-481 high-wattage flashers for non-flashing lights or a CG-481 high-wattage *slave* flasher for flashed lights. If total three or four RL-14's are required to meet your daytime signal intensity needs, a second RSB-DC is usually required to manage the load. Please refer to standard drawings **140506** and **140507** for these greater-intensity cases. Also, COMDT(G-SEC-2A) Technical Data Sheet **TD-01-01** (<http://www.uscg.mil/systems/gse/gse2/techsheets/01-01.pdf>) provides more options and specific guidance on modifying the RSB-DC(s) for higher-intensity daytime signals. The nighttime RL-14 range light will usually contain a smaller less-intense lamp, such as the standard 1.9A CC8 lamp, along with the standard CG-493 flasher and CG-6P lampchanger group.

12VDC - Power Supply. The power section consists simply of a 12VDC power supply running off commercial 120VAC via an ac power service breaker box instead of solar. In other words, the entire solar power package is replaced by a single standard AtoN High-Watt Power Supply (HWPS) which feeds the RSB-DC directly; otherwise, the control system and signal hardware are identical to that of the 12VDC - Solar Photovoltaic power/control combination described above. Drawing **130506** depicts this configuration.

120VAC. As the title implies, commercial 120VAC is the power source. 120VAC is brought up to the RSB-AC via an ac power service breaker box. A commercially available and self-contained Type K AC daylight control installed outside the RSB-AC continuously monitors outside ambient light conditions. Also, depending on ambient light levels, the Type K DLC directly controls the operation of the AC power relay by toggling it between de-energized (daytime signal on) and energized (nighttime signal on) modes. Unlike the failsafe condition of the RSB-DC, the RSB-AC's power relay is *energized* in the failsafe mode; however, like the RSB-DC, it will also failsafe to the less-

intense nighttime signal. Due to the nature of the Type K's design, a failure of its internal workings (failsafe mode) will automatically and permanently command the RSB's power relay to energize, forcing the range light into nighttime mode. Since the Type K DLC's probability for failure is higher than that of the more rugged power relay, this was the logical design choice. If the daytime range is flashed, an AC Flash Controller (ACFC) is required to flash the 1,000W lamps in an RL-24 range lantern. For lower-intensity daytime ranges, a FLAC 300 AC flasher is used to flash the 150W and 250W lamps in an RL-14 range lantern. When the Type K DLC determines that it's bright enough to switch to daytime signal(s), the RSB-AC activates the ACFC (or FLAC 300) by applying full 120VAC power to it. The ACFC, in turn, flashes the range light according to the rhythm of the integral CG-493 programmable flasher while a FLAC 300 flashes the range light according to its on-board rhythm selector circuit. Lampchanging for the 1,000W lamps is provided by the standard CG2P-1000 lampchanger mounted inside the RL-24 daytime range lantern. Lampchanging for the 150W and 250W lamps is provided by the standard CG-4P lampchanger in conjunction with the FLAC 300 inside an RL-14 daytime range lantern. If a daytime signal of intensity greater than that provided by a single RL-24 with a 1,000W lamp is desired, an optional RL-24 may be installed in "parallel" with the first light. If an even greater daytime intensity is required, Technical Data Sheet **TD-01-01** provides specific guidance on how to modify the RSB-AC to accommodate three RL-24's. The nighttime signal is usually an RL-14 with 150W or 250W lamps and a CG-4P lampchanger. If the nighttime signal is flashed, a FLAC 300 is required. Please refer to drawing **130503** for these cases.

Important Note:

During storage, especially in humid environments and over long periods of time, a layer of tarnish may build up on the power relay's contacts in Range Switch Boxes. This unwanted layer of tarnish acts as an insulator and will impede proper current flow to the light signal(s). As a general rule, after initial installation or after relay replacement, we recommend that all contact surfaces of the power relays are cleaned with a spray-on contact cleaner and a lint-free cloth/swab (the manufacturer recommends against using a burnishing tool). Once the system starts operating normally and properly switching between the day and night signals, the daily mechanical action of the relay along with the heat generated by sudden current flow across the relay's contacts helps mitigate the corrosion problem.

Emergency Range Lights. Emergency Switch Boxes (ESB) are available for ranges that have a separate and independent 12VDC backup power source to support an optional emergency range light. The ESB-AC continuously monitors the 120VAC commercial power source entering the RSB-AC and during commercial power outages activates a contact closure thus enabling the 12VDC emergency range light to turn on. Similarly, the ESB-DC continuously monitors the actual 12VDC power entering the RSB-DC from either the RPB (solar power), SCC (solar power), or power supply (commercial power) and activates a contact closure enabling the emergency range light during a battery/commercial power failure. For more detailed information, please refer to standard drawing **140505** for the 12VDC version and **130505** for the 120VAC version.

Spare Parts. In support of standard day/night ranges, a comprehensive spare parts kit is available and ready for immediate issue to servicing units that can demonstrate the need for having one. The Spare Parts Kit for Standard Ranges contains all items of probable failure that may be necessary to repair a typical malfunction in a standard day/night range; except tools, of course. These kits are listed in our AtoN equipment webpage (<http://www.uscg.mil/systems/gse/gse2/2A-equipment.htm>) under Part Number/NSN CG5999-01-GL7-6227. However, since not every problem is "typical" or predictable, additional equipment may be needed for unusual problems. In any event, these kits should handle the majority of all problems quickly and easily. The kits may be obtained from ELC Baltimore stock by email (or letter) request to COMDT(G-SEC-2A). By clicking on the **Source** listing for the kits at the website above, an automatic email request form is generated for your convenience. In your written request, please list the names of all standard day/night ranges that use the RSB-AC or RSB-DC in your AOR so that COMDT(G-SEC-2A) can evaluate your needs quickly. Replenishment of the kits is the responsibility of the ANT or servicing unit. Components used in the kits are listed both on our website under the AtoN Equipment List and also in documentation included with the kits. Some items are free-issue and some items must be purchased either through the stock system or commercially from the manufacturer or supplier/distributor.

Final Words of Caution.

- When working with 120VAC systems please exercise extreme caution to prevent injury from the dangerous high voltage. Ensure that power is properly secured and tagged at the source during initial system installation and during routine preventive maintenance and troubleshooting visits.
- Please ensure that spread lenses, if you have any, are installed properly; i.e., check to make sure that the light-spreading "stripes" within the lens are lined up **vertically**.
- Ensure that all wires, especially high-current carrying 12VDC power lines, are sized properly (that is, sufficiently large such that line voltage losses are minimized) and that all connections are secure and tight.
- Finally, ensure that every position of the lampchanger(s) contains the correct size lamps, especially if your system is solar powered.

For further information or assistance, the Signal & Power Team POC is Mr. Kam Agi, tel: 202-267-1872, email: kagi@comdt.uscg.mil